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Adaptation trajectories and challenges in the Western Ghats: A case study of Attappady, south India

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ABSTRACT

Climate change adaptation has become an important aspect of research and policy agendas at different scales – globally, nationally and locally. One stream of thought relates to the thematic area of barriers or challenges that adaptation faces. This article explores local adaptation trajectories and challenges in a tribal development block in south India. Through the lens of key livelihood strategies pursued in the block – namely income from development interventions, migration and on-farm strategies – it explores the challenges and factors that contribute or have contributed, to impeding successful adaptation outcomes in Attappady. The article argues that development interventions (i.e planned adaptations) have not succeeded in addressing structural causes of vulnerability; they have, however, provided an important coping mechanism. Migration is a socially and culturally differentiated phenomenon and is not a viable diversification option for the most vulnerable population segments in Attappady. Finally, it is found that recent on-farm adaptation strategies present a case of maladaptation that promote marginalisation and are ill-suited to the local ecological and cultural landscape.

1. Introduction

Adaptation to environmental change is a time-tested phenomenon, characteristic of collective and individual action in human societies. Adaptations can take various forms, such as developing seed varieties, constructing water storage facilities, forming risk management institutions, and facilitating behavioural change. The purposes of adaptation processes and actions include the reduction of risk and uncertainties stemming from events precipitated by environmental change and related hazard events, including those from climatic variability and change. Ultimately, they aim to secure the prosperity and wellbeing of communities in a given spatial context. Successes and failures of adaptation have been documented historically, as with the demise of the Norse population in Greenland for instance, or the collapse of civilisations due to prolonged drought periods (Diamond, 2005; deMenocal, 2001).

In the context of anthropogenically induced climatic changes and related public and policy debates, adaptation studies have gained widespread visibility and added vigour. Governance debates and research agendas revolve around understanding, providing and creating effective levers and mechanisms to foster adaptive capacities and action at different tempo-spatial scales. These deliberations range from the global to the local, involving multiple actors and science perspectives.

One line of inquiry concerns the reaching of tipping points or thresholds beyond which adaptations become impossible or are no longer feasible (Lenton et al., 2008). Shifts and alterations in biophysical systems can lead, in extreme cases, to species extinction and render adaptations futile. The Intergovernmental Panel on Climate Change (Adger et al., 2007) sees such limits as being firmly rooted in ecological and physical attributes of a system. Barriers to adaptation can, on the other hand, be surmountable, even in the face of stress on system attributes. Adger et al. (2007:733) define these barriers as 'the conditions or factors that render adaptation difficult as a response to climate change'. Technological and economic developments can enhance, stretch or overcome certain barriers but also have recognisable limitations (Agrawala and Fankhauser, 2008; Parmesan and Yohe, 2003). Beyond clearly defined ecological and physical limits and their technological and economic components, socially rooted limits and barriers pose quite different questions and are more 'fuzzy'. Attributes of social and cultural systems located in institutions, power relations, knowledge, values and belief systems influence the ability to adapt and are recognised in an emergent literature (Naess et al., 2005; Robledo et al., 2004; Adger et al., 2009; Dow et al., 2013). Rather than referring only to barriers, this article views social and cultural aspects as challenges that can impede sustainable adaptation outcomes.

India is one of the most climate-vulnerable countries in the world. Its biophysical systems are highly sensitive to added climatic exposure and its population remains largely dependent on climate-sensitive

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sectors of the economy, with limited capacities to adapt in the face of widespread poverty, marginalisation, social exclusion and poor institutional capacity (Maplecroft, 2014; Hijioka et al., 2014; Dreze and Sen, 2013). Geographically, the Western Ghats mountain range along India's south-western flank is classified as highly vulnerable to climatic changes (Nandakumar, 2014). Attappady is located in this region and forms an administrative division in the south Indian state of Kerala. It has experienced widespread environmental change and is home to a sizeable indigenous population. In response to severe environmental and social stress experienced during the past decades, various livelihood strategies have been adopted and promoted in Attappady. Three key livelihood strategies, namely income from development interventions, migration and on-farm strategies, provide the starting point from which this article seeks to examine key trajectories and challenges to adaptation.

The article distinguishes between autonomous and planned adaptation. It argues that state-led development interventions (i.e planned adaptation) provide an important coping mechanism but have not significantly contributed to the promotion of enduring adaptation trajectories; that migration is a culturally and socially differentiated phenomenon which is not readily available as an outlet to some population segments; and that the sustainability of adaptation towards market-driven, perennial cash crop (plantation) agriculture is questionable.

2. Adaptation, livelihoods and socio-cultural processes

The socio-economic impacts of climatic change are varied and documented to lead to livelihood disruption, occupational and income loss, reduced wellbeing or premature death – effects that are unequally distributed across societal sections (IPCC, 2014; Ribot, 2010). Rural dwellers in developing countries in particular, experience additional pressures in their day-to-day life (Francis, 2000). Adaptation to environmental change is a complex process, embedded in a fluid climate–society relationship that remains subject to a continuing debate on meaning and interpretation. Taylor (2015), for instance, questions the premise of an artificial climate-society dichotomy that treats the climate as a separate, governable entity and yet informs much of the climate change adaptation debate. Adaptation responses are, therefore, closely linked to the way in which the problem is diagnosed and framed, that is, what generates vulnerability to climate change? The IPCC (2014:5) proposes a definition of climate change adaptation as: 'a process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities'. This article goes beyond seeing adaptation merely as a response to climate stimuli in a separated human–environment system; adaptation is understood to be part of an existing vulnerability context premediated by historically conditioned and scaled, socio-economic, cultural and ecological factors. It also responds to Ribot's critique of 'locating causality within the hazard' (2014:667), and the undue focus in the risk-hazard literature on proximate causes for vulnerability, which sidestep interacting socio-ecological processes that leave people vulnerable in the first place. Environmental change is but one stressor that dynamically interacts with social systems and potentially amplifies or re-configures existing vulnerability patterns - as Ribot (2010:1) pointedly states 'vulnerability does not fall from the sky'. In a natural science framing however, adaptation to climate change is more concerned with homogeneous, quantifiable limits, costs and benefits, and responses concentrating on techno-managerial solutions (O'Brien and Barnett, 2013). Barriers and limitations to adaptation are accordingly defined and located. A contextual framing provides for qualitative analysis of these and acknowledges the importance of existing social and cultural processes in understanding and framing adaptation responses (O'Brien et al., 2007). Taylor (2013), drawing on research in south India, illustrates how vulnerability is a relational and socially embedded phenomenon that requires in-depth analytical insights and practical engagement with issues of power, in the absence of which, oppressive and unequal socio-economic structures (i.e caste system) risk continuous reproduction. A growing body of critical studies also highlights how existing adaptation projects might assist people, but at the risk of obscuring fundamental questions of politics and power (Eriksen et al., 2015; Brown, 2014). Landlessness, patriarchal gender relations, caste system hierarchies or lack of rights, leave people disempowered and impede the ability to respond to or recover from rapid environmental changes and events. Without due attention to socio-political dynamics and ingrained power relations that lie at the root of vulnerability, transformative changes are unlikely to be achieved (Ribot, 2014).

Adaptation can be planned, i.e be a deliberate policy effort borne out of awareness that changes have taken place and require concerted action to redress (e.g construction of sea walls, social protection); or adaptation can be autonomous in that it takes place regardless of broader plans and policy (Huq and Klein, 2013). The latter is largely driven by decisions at individual or household level to reduce risks and can refer to behaviour change, for example in agricultural practices or water management, but can also include opportunity induced responses to market signals. A distinction is also frequently drawn between coping and adaptation. Coping is a process that can involve days, months or a few years; adaptation can involve longer timescales (Smithers and Smit, 1997). For example, changing agricultural systems in response to climatic changes can take decades, while responses to individual climatic events can involve shorter periods. At the same time, coping processes are facilitated by adaptation. By strengthening coping abilities, requirements for adaptation can potentially be reduced (Eriksen et al., 2005).

The literature concerning livelihoods identifies different strategies adopted by households to cope with or adapt to livelihood stresses, and is widely used in social vulnerability analysis (Adger and Kelly, 1999). A livelihood 'comprises the capabilities, assets (including both material and social resources) and activities required for a means of living' (Scoones, 1998:5). Pursued strategies can relate to agricultural extension or intensification, livelihood diversification and migration. For instance, severe and persistent drought can prompt family members or households to relocate to other areas in search of alternate livelihood options. Livelihoods research has played an important role in examining how and why different actors and institutions have responded in varied ways to foster livelihood security – or why they have not (Ellis, 2000; Elmqvist and Olsson, 2007).

Social and cultural processes have found increasing recognition in development research with respect to governing, mediating and augmenting the access to livelihood capitals and influencing livelihood outcomes and strategies (Daskon, and McGregor, 2012; de Haan and Zoomers, 2005). They also play an important, yet often underplayed, role in climate change adaptation. Culture is composed of the totality of art, symbols, language, rituals that are intermeshed to create a common, yet differentiated, identity, values, gives meaning to a place and flows into collective decision-making (Suchman, 1995). Climate change impacts can influence or obviate traditional livelihood practices, such as hunting in the Arctic (Seguin Furgal and Seguin, 2006). Cultural aspects also influence adaptation pathways by effecting socially differentiated decision-making (Adger et al., 2013). Nielsen and Reenberg (2010), in a study in Burkina Faso, elucidate that 'cultural sensitivities' can give rise to heterogeneous adaptation pathways, exhibited through non-linear actions by different community members and play a particularly important role when it comes to looking beyond a short-term coping ability.

The identification of the events and processes that harm valued objects at risk are diverse, context-dependent and socially and individually differentiated with response processes and mechanisms contingent on this prior identification. Capacities to respond are in turn anchored in institutions, structures, values and knowledge systems. Social and cultural aspects thus condition the ability to appropriately respond to climate impacts and prioritise certain actions and groups

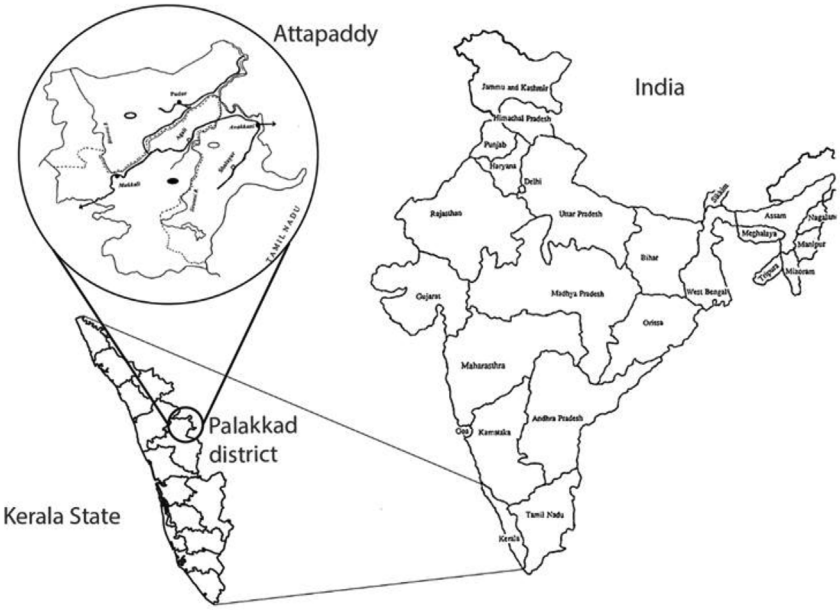

Fig. 1. Map of Attappady.
Source: Adapted from Velluva (1999).

over others. Jones and Boyd (2011), for example, categorise social and cultural barriers into cognitive behaviour (risk averseness), normative behaviour (unwillingness to depart from traditional cultural practices), and governance institutions (social discrimination, lack of flexibility). Similarly, social differentiation in terms of wealth, gender or education influence vulnerability patterns and give rise to differentiated coping strategies (Eriksen et al., 2005). In contrast to biophysical limits, Adger et al. (2009) emphasise that social barriers are 'mutable' with the right mix of political, social, institutional support and effort, and resource allocation.

3. Study area: an overview

Attappady Block is an administrative division of the south Indian state of Kerala and comprises one of 13 blocks in Palakkad district (Fig. 1). It is located on an eastward sloping plateau in the Western Ghats hill range and borders Tamil Nadu to the east. The total land area is 745 square kilometres with a population of 69,723 people (GOI, 2014). It was declared a tribal development block as early as 1962 and is composed of three panchayats (administrative units at village level), namely Agali, Pudur and Sholayur. Agali holds nearly half the population of the Block, with the rest distributed about equally between the other two panchayats (GOI, 2014).

Agriculture is the mainstay of the economy. Fruits (plantains – especially banana), coconut, spices and condiments (pepper, cardamom, arecanut, ginger), tubers, vegetables, plantation crops (tea, coffee, rubber) are the dominant crops cultivated. Traditional tribal crops are essentially rain-fed and comprise millets such as *cholam* (maize), *ragi* (French millet), *chama* (little millet) and other pulses, vegetables and oilseeds. Mining and construction are minor economic activities.

The population is composed of a mixture of 'general[1]' settler population sections who migrated to Attappady over the past century, and indigenous people.[2] Indigenous people, here referred to as 'tribal', are composed of three distinct communities, Irula, Muduga and Kurumba. Irula are by far the largest group (77 per cent) followed by Muduga (13 per cent) and the more remotely settled Kurumba (10 per cent). While they exhibit differing cultural practices and ethnic traits, they share similarities in lifestyle, agricultural practices, a historical dependence on land and forest resources for subsistence and socio-economic conditions (Menon, 1996; Kunhaman, 1981). Notable commonalities lie in social structures, with each of the groups having a *moopan* (village chief) and *manukkaran* (agricultural manager), the latter determining sowing season and management of crops. These are the two most important persons in the traditional social hierarchy. Some Kurumba hamlets still practise slash-and-burn agriculture in the high ranges and collect forest produce. All groups cultivate dry land crops, but have increasingly assimilated agricultural practices by the settler community and turned to casual labour employment (Velluva, 1999). As casual labourers they mostly work at low wage rates or in exchange for produce on plantations and farmsteads of the settler community, in tribal co-operative societies and in the construction sector. Irula are found in all parts of the Block, while Muduga are concentrated in Agali, and Kurumba are settled in the more remote, forested highlands of the Block. For the purpose of this study, these groups are referred to as the 'tribal community'.

The 'general' non-tribal community is also composed of different ethnicities and groups. They overwhelmingly arrived in phases as migrant settlers during the past six decades from the states of Kerala, Tamil Nadu and Karnataka; however, no accurate figures are available regarding their relative ethnic and religious configurations. Christian and Muslims settlers come largely from the plains of Kerala while Hindu settlers are from both Tamil Nadu and Kerala. Settlers from Kerala established themselves on the western slopes, mainly in Agali but also in Sholayur, and Tamil settlers concentrated in Pudur (on the eastern slopes), carrying with them accustomed agricultural practices from the plains that dominantly involve cash crop cultivation (Velluva, 1999; Haseena, 2006).

The decades from the middle of the 20th century were accompanied by interventions that contributed to land-grabbing, large-scale deforestation, land and water resource degradation as well as social marginalisation and pauperisation of tribal communities (Muraleedharan et al., 1991; Velluva, 1999; Sathis, 1989; Kunhaman, 1981; Radhakrishnan, 2012; Haseena, 2006). These echo experiences of the marginalisation of tribal communities in other areas of the Western Ghats region (Kjosavik and Shanmugaratnam, 2015).

[1] Colloquial reference to non-tribal community members not falling under reservation policies.
[2] Alternatively referred to as *Adivasi*.

Factors that contributed to these developments can be located in a mutually re-enforcing relationship between political economic factors and environmental change. For one, tribal communities are perceived as 'primitive' by other communities; they don't adhere to rules and norms governing the other dominant social systems in India (e.g they historically fall outside the caste system), do not follow private property rules and observe distinct religious practices such as animism. The emergence and integration into regional and national economies, push-and-pull factors, in addition to government policy and legislative Acts drove and drew migrants to the lands of Attappady. For instance, between 1951 and 1981 the share of the settler community increased from 9 percentage to more 60 percentage in the span of only three decades (GOI, 2014). The changes strongly influenced the life and wellbeing of tribal communities, with their subsistence economies progressively eroding. Given the lack of knowledge to navigate an emerging market economy in the backdrop of a largely self-contained 'moral' economy based on trust an reciprocity, integration with the regional, competitive economy proved difficult, and unfeasible in the short run. At the same time, large tracts of customary land holdings were lost and they were pushed into more marginal lands. By 1982, 63 per cent of tribal land holdings were estimated to be usurped, mostly by the arriving settler community but also through government land appropriation (D'Rozario, 2013). A large share of private land transfers can be traced to the financial and legal illiteracy of the tribal communities, indebtedness and forceful acquisition (Velluva, 1999) – reflecting highly unequal power relations. Socio-cultural institutions started to erode in this process as well, and traditional agricultural cultivation practices became increasingly difficult to pursue. Extensive environmental degradation and change coupled with marginalisation proved to be mutually re-enforcing pressure points. Poor health, illiteracy, malnutrition and material poverty are widespread and significantly higher among the tribal communities (Manikandan, 2014; Prabhakaran, 2014).

3.1. Climate and ecology

Attappady is home to a diverse climate and ecology. Geographically, the panchayats are located as follows: Pudur to the north-east, Agali on the central western side of the plateau, and Sholayur on the south-western flank. The plateau is undulating and ranges in elevation from 550 m at its lower points, to more than 2200 m at its peaks. The central plateau is the most heavily populated area and has an elevation of between 600 and 1000 m. Around 51 per cent of the terrain is located there. Steep slopes characterise the landscape, and make them environmentally sensitive. For example, 71 per cent of the slopes have a gradient between 15 and 30°. Rainfall patterns are diverse and vary sharply, with the dichotomy lying between the western and eastern areas of the Block as illustrated in Fig. 2 (a). Rainfall patterns are closely connected to topographical diversity and location on the plateau. Annual precipitation ranges from 700 to more than 3000 mm. The western parts receive the bulk of precipitation from both the south-west monsoon and parts of the retreat (north-east) monsoon. Consequently, this part of Attappady is wet, moist and humid for most part of the year. As illustrated in Fig. 2 (b), majority of the agricultural lands are located in the central valley and western flanks. The eastern parts, on the other hand, receive the bulk of precipitation from the retreat monsoon and are drier and hotter throughout the year. The dry season in the eastern section lasts between five and seven months and this is where most of the degraded forest land is located.

Temperatures average around 17 °C and differ seasonally, with a hot and dry summer between March and May, and a cooler winter in November to December. A forest cover of 83 per cent in 1957 reduced to 20 per cent by 1996; this was accompanied by a change in micro-climatic patterns combined with land resource degradation (Kunhaman, 1981; Radhakrishnan, 2012). Apart from general land quality degradation and attendant impacts on agrarian practices, changes in precipitation have been recorded from the 1970s onwards with droughts, especially in its eastern parts, occurring more frequently (Sathis, 1989). The two most important rivers are the eastward-flowing Bhavani and Siruvani that are fed by a number of smaller tributaries. The administrative division in which Attappady lies has been classified as one of the two districts in Kerala that are highly vulnerable to climate change, with temperature predicted to rise in the range from 2 to 4.5 °C over the next decades (Nandakumar, 2014).

3.2. History of development interventions

In the context of these socio-economic and ecological conditions, development interventions orchestrated by state actors have had a long history in Attappady; they leave behind an archetype of programmatic ideas, approaches and institutions. After its establishment as a tribal development block in 1962, Attappady's development was guided by the special provisions for tribal communities in the Constitution of India. The accent of interventions lay on the provision of basic access to services catering to the specific needs of a 'backward' area and its tribal inhabitants. Interventions initially centred on social and physical infrastructure by developing roads, irrigation, educational and healthcare facilities. Representatives of tribal hamlets, in coordination with the administration, shaped these projects. In 1975, the Block was re-constituted as an integrated tribal development project (ITDP) which was meant to alleviate some of the deficiencies of the earlier interventions by focusing on an integrated rather than a sectorial approach. For this purpose, all activities in the Block were coordinated through the nodal ITDP. Some 22 departmental activities from agriculture, financing, electricity to healthcare, fell under its authority – under the leadership of the District Collector and a Tribal Advisory Council. Subsequently in the 1970s and 1980s, livelihood diversification and natural resource management programmes started to become part of development interventions – directed by the Integrated Area Development Approach. Rearing of livestock, marketing of agricultural produce, irrigation projects and the introduction of cooperative farming societies followed and resulted in the establishment of 18 cooperative farming societies and nine dairy cooperatives. In the 1980s, earlier governing structures were replaced by district-level working groups, headed by political representatives and local officials. These sidelined earlier structures that drew on the representatives of tribal institutions (Sasidharan, 2005). In the 1990s, national-level rural development programmes included various employment generation, self-employment, health and agricultural schemes. These included the Integrated Rural Development Project, Jawahar Rozgar Yojana, Million Wells Scheme, Attappady Valley Irrigation Project, Integrated Wasteland Development Project, and Swarnajayanti Gram Swarojgar Yojana or Indira Awas Yojana. In 1996, as part of the 'Peoples' Planning Campaign' in Kerala, the decentralisation process granted more autonomy to local self-governing institutions in development planning, that is, to the block, gram panchayats and ward units. This move once again changed institutional dynamics and development planning.

The most comprehensive development project in Attappady to date commenced in 1996, under the head of the Attappady Wasteland Comprehensive Environmental Conservation Project, implemented through the Attappady Hills Area Development Society (AHADS) based in Agali (AHADS, 2010). This was a 219 crore INR[3] project financed by the Japanese Bank for International Cooperation and can be described as the first major, integrated attempt at planned adaptation. It aimed to provide employment, eco-restoration and promote the active participation of tribal hamlets in development activities taking into cognisance their evolving development and ecological context. For this purpose, a new set of institutions was created at hamlet, macro and micro-watershed levels. For instance, each hamlet was entrusted with a hamlet development committee (*ooru vikasana samidhi* or OVS) to plan,

[3] Approximately USD 34 million.

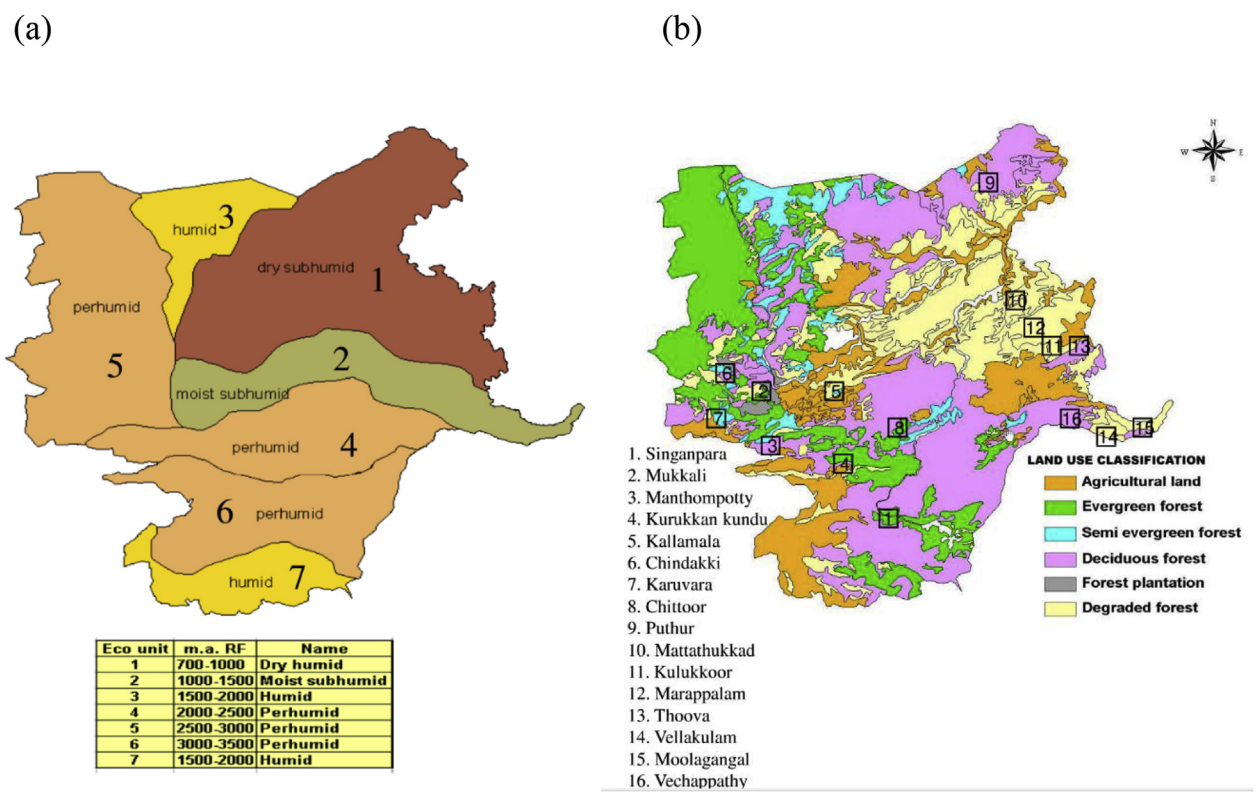

Fig. 2. Different ecological zones and land use patterns in Attappady.
Source: Radhakrishnan (2012).

coordinate and implement development projects in its locality. The project started in 1996 and ultimately ceased in 2010. Following the AHADS project, the Mahatma Gandhi National Rural Employment Guarantee Act[4] (MGNREGA) was instituted in 2006 and coexisted with AHADS for a brief period. The MGNREGA (NREGA, 2005) is a national-level rural development scheme, also identified as a potentially suitable tool for planned climate adaptation (Adam, 2015). It has been the most significant development intervention in Attappady over the fieldwork period. The scheme utilises existing decentralised governance structures, as well as some of the institutions created under AHADS (namely OVS), to provide employment, foster agricultural development, social inclusion and strengthen decentralised governance institutions. In conjunction with the MGNREGA, another 100 crore INR[5] plus, special package under the National Rural Livelihood Mission (NRLM) was announced in 2013/14 to promote self-employment, rejuvenate agriculture and extend basic healthcare services to Attappady. Overall, a brief characterisation of developmental interventions and planned adaptive components, displays a shift in the approach from 'top-down', technical interventions towards local democratic institutions, incorporating a formal acknowledgment of cultural pluralism and natural resource management.

4. Methodology

Data collection was carried out over from 2011 to 2014. Semi-structured interviews, key informant interviews, participant observation and focus group discussions provide the primary data. In addition, literature from official reports as well as relevant studies were sources. One of the initial research purposes of the larger project which the author was part of, was to study the role of a governmental scheme (MGNREGA) in the Block with respect to vulnerability reduction. As a result, 190 semi-structured interviews were drawn from the scheme's participants. This method presents certain limitations, such as not capturing non-participants in a dedicated way. However, half of the households in Attappady are formally registered with the scheme,[6] with both tribal and non-tribal populations being represented. This also has the advantage of enabling the study of income from development intervention as a coping strategy. This data set is supplemented by 25 key informant interviews, which were conducted with resource persons who have an overview of contemporary and historical development together with environmental issues that affect the Block. Key informants included community leaders, politicians, social activists, academics, government officials and local residents. Topics of discussion were loosely structured around an open-ended interview guide and centred on development interventions, such as the MGNREGA and AHADS, local climatic changes, agricultural and socio-economic issues. A snowballing technique helped in locating appropriate respondents. Five focus group discussions were held in different locations of the Block. Given the Block's demographic and ecological diversity, these were held in the eastern, western and central part with a view to gain insights on spatially distributed development concerns.

5. Research findings: adaptation trajectories and challenges

5.1. Income from development interventions as coping strategy

During the fieldwork, it became apparent that government schemes play a key role in the coping strategy of vulnerable people, with perceptible differences in engagement existing between tribal and non-tribal households. Pudur hosts the most unfavourable climatic conditions in the Block, with a drier climate, higher rainfall variability and

[4] Guarantees every rural household 100 days of employment against a minimum wage, if demanded (NREGA, 2005).
[5] Approximately USD 15 million.
[6] Registration does not necessarily translate into effective demand for work.

extensive land degradation. Limited agricultural operations with few other employment options exist. Pudur has also the highest tribal community share, within the respective panchayats. From 2013 to 2014, 83 per cent of the workforce in Pudur was engaged in the MGNREGA, compared to 53 per cent in Sholayur and 50 per cent in Agali (NREGA, 2014). Pudur had 69 employment days, with 61 days in Agali and 56 days in Sholayur[7] during that time span.

Agali has the highest share of non-tribal communities and its environmental conditions are more conducive to viable agricultural operations. Focus group discussions held in the respective localities revealed the following.[8] In Agali, non-tribal respondents mentioned that they could draw on a wider portfolio of coping mechanisms such as migration, kinship networks, church groups, access to formal and informal credit sources or draw on their asset bases. Employment in government schemes does play a central role in coping strategies, but is just one of a subset of avenues. The MGNREGA is viewed critical by some respondents, especially non-tribal land owners, who see in it a 'hand out' scheme that has impacted labour availability and increased expenses for agrarian operations. On the other hand, in Pudur,[9] both tribal and non-tribal population sections expressed their pronounced reliance on government employment programmes for sustenance. Social differentiation also persisted there. For non-tribal households (as was the case in Agali), stronger social structures and horizontal economic linkages enabled the diversification of income sources. Social and economic structures thus provide a degree of resilience which is less pronounced than that of tribal households. Tribal households exhibited a much stronger reliance on government employment, in the absence of capacities for autonomous adaptation. According to one tribal respondent[10], 'For many months there is absolutely no other work besides the 100 days employment[11] scheme'. Weaker capabilities and diversification options can be explained by limited human capital (high rates of illiteracy[12]) and limited asset bases, ill health among men (related to substance abuse, especially alcohol) leading to increased health costs and limited employability, limited access to formal credit, and widespread, poverty-like conditions in tribal villages, all of which restricted support from social networks. Significantly higher mortality rates among men due to poor health leave a large number of the interviewed households with women as heads, who carry the double burden of daily reproduction of the household through household chores including care of family members, and as the main wage earners. Similarly, in the absence of significant agricultural activities, even casual employment options on farmsteads are not available during the lean season. In Agali and Sholayur, tribal households exhibit similar tendencies of dependence on state support – but during the agricultural season at least, more casual labour opportunities existed, which helped to diversify income.

Another indicator for the reliance on governmental support to tide over livelihood crisis is the place that the Public Distribution System (PDS)[13] holds. More than 70 per cent of tribal households in Attappady fall into the 'below poverty line' (BPL) category (KILA, 2008). Respondents emphasised that an important source of food security was the purchase of subsidised rice from ration shops. By contrast, the number of non-tribal households who are eligible for this subsidy is significantly less. Non-tribal respondents commented that the quality of the rice sold was poor; most respondents preferred not to purchase it and were rarely obliged to use it. It presents an option but it is not a necessity.

As the fieldwork progressed, it became apparent that – rather than being a temporary and reactive coping strategy or merely a supplement to household income – state support, whether through subsidised food or employment, exhibited signs of a 'reliance' relationship between large sections of the tribal community. This relationship of reliance was planned and not temporarily confined to environmental and economic stress events. It points to general conditions of duress, anchored in interacting political economic factors and ecological conditions, but feeds into the question of the role that planned adaptation, through state-led developmental interventions may or may not have played. Attappady, as outlined, has been subject to a host of these interventions over a considerable period of time. Apparently these have not addressed the structural barriers to adaptation and enabled the building of adaptive capacities for more autonomous adaptation practices. Issues of relatively low levels of human development, unequal access to assets, capital and credit, and the resulting social exclusion still persist. Moreover, as mentioned earlier, the tribal hamlets continue to be located in increasingly climate-vulnerable, and exposed environments. The fact that these interventions have not successfully removed barriers, raises the spectre of whether the 'historical baggage' of interventions has also affected the engagement and expectations of the intended beneficiaries with respect to state institutions, and thereby has limited the scope for future interventions. Could this add challenges to planned adaptation by adversely affecting the trust and legitimacy relationship? Also, have coping activities undermined or disincentivised autonomous adaptation activities and potentials?

State institutions can provide opportunity structures that enable and improve access to social, political and economic assets and capital. The MGNREGA has been documented to play an important role in tackling proximate vulnerability patterns of marginalised people in Attappady and arguably has potential to foster adaptation; at the same time, however, it is not transformational and its long-run outcomes still need to be discerned (Adam, *forthcoming;* Adam, 2015; Kjosavik and Shanmugaratnam, 2015). Nevertheless, an important effect of the scheme has been the provision of employment and income earning opportunities for women, who comprise more than 90 percentage of the MGNREGA's participants in the case study area and belong to the most disadvantaged groups in Attappady. Wage payments, besides providing income to help meet immediate family needs, facilitated access to formal banking and raised minimum wages. Among the interviewed respondents, 115 (61%) opened a bank account for the first time in their lives, to receive MGNREGA wages. Eighty of these 'first-timers' (70%) belong to tribal communities. Yet, in practice, given the limited knowledge to navigate the formal banking system as well as lack of eligibility for loans, respondents rely dominantly on co-operative loans (through women's *Kudumbashree* self-help groups) and informal systems such as money lenders. The latter usually belong to the better resourced settler community and charge exorbitant interest rates. Indebtedness is widespread, and repayment of loans comprises the second highest expenditure item of interviewed respondents - after food. Historically, it is precisely this skewed debt relationship, anchored in the social relation of the region, that forced transfer of lands which underwrote loans (Velluva, 1999; Haseena, 2006). Despite the raising of minimum wages, male labourers in the agricultural sector earn between 50 and 100 percentage higher daily wages (depending on the type of work and ethnic origin), reflecting highly unequal and gendered remuneration regimes.

Beyond the immediate functioning of governmental programmes such as the MGNREGA, a history of unmet expectations and underachievement has added to a palpable sense of despondency and 'intervention fatigue'. The trusteeship relationship demonstrated by the government in drawing up schemes specifically for the tribal communities, also amplifies tendencies for their social stigmatisation. An often repeated assertion that was encountered in the field was 'this [MGNREGA] is just another government scheme, we have seen them

[7] Sholayur has an approximately equal distribution between tribal and non-tribal communities.

[8] Group interview: 6 February 2013.

[9] Group interview: 9 February 2013.

[10] Interview: 19 March 2012,Mulli, Pudur.

[11] '*thorilnurruppu*' is a colloquial reference to the MGNREGA in Kerala.

[12] The last authoritative literacy count puts literacy rates at 38 per cent of the tribal community (Census, 1991) with more recent reports stating 62 per cent were functionally literate (The Hindu, 2013). However, the latter number is viewed critically by this author.

[13] The PDS provides subsidised rice in a monthly allocation to BPL and APL (above poverty line) card holders. BPL card holders receive 25 kg of rice at 1 Rupee.

coming and going' while at the same time substantiating that 'we need more help from the government'.[14] This relationship of reliance on state assistance has become ingrained in the cultural matrix of the intended beneficiaries and has come to define expectations of a persistent inflow of development support as a crucial lifeline – but is mixed with reservations, apprehensions and lack of faith in programmatic approaches that lead to tangible improvements in the quality of life.

A woman tribal social activist puts this state of affairs eloquently: 'Our children don't know much about our land, people and traditions anymore; basically they know us [tribal people] as people of *ration ari* (ration rice). I don't want my children to look upon us and think of our people and themselves in that way'[15]. This statement encompasses an intergenerational aspect, in that a whole generation grew up with external support providing a critical lifeline for sustenance. This adds to the question of whether planned interventions have only addressed symptomatic causes for distress and not encouraged more encompassing changes that foster substantial empowerment and allow for the diversification of household income away from government support, possibly even having deflected from processes of vulnerability generation.

Programmes have repeatedly promised the promotion of 'sustainable livelihoods' and raised expectation levels. For example, the AHADS mission objective speaks of 'halting the processes of ecological and social degradations and improving the livelihood base of the affected [tribal] communities' (AWCECOP, 2008:5). The project, seeing itself as a role model for community development (AWCECOP, 2008), became dysfunctional in 2010. Positive experiences have been documented, especially with respect to water resource development and participatory institutions (Vishnudas et al., 2012). But instead of being self-sustaining, the project and its institutions became largely dysfunctional, with outcomes staying within the realm of physical infrastructure build-up and some ecological improvements (Takaki, 2012). When respondents were asked about User Associations (created as micro-watershed development committees under AHADS), they were not even clear what had happened to these associations or whether they were still in place: 'That was under AHADS; they don't function anymore – or do they?' A question posed by the researcher returned as a counter-question as to whether the researcher could provide clarity on status. After AHADS was wound up, its previously crafted institutions were sidelined and employment provision ground to a halt. OVS units have been integrated with the MGNREGA since then, but are now working under conditions that are embodied in MGNREGA guidelines, rather than those of AHADS. Concurrently other schemes have existed or come into existence with various agencies, grassroots organisations and institutional bodies entrusted with their planning and execution. Similarly, the re-christened National Rural Livelihood Mission, with a new set of institutions, aims to 'reduce poverty among rural BPL by promoting diversified and gainful self-employment and wage employment opportunities which would lead to an appreciable increase in income on a sustainable basis.' (PIB, 2015). Given the maze of institutions and their frequently changing composition, there exists confusion as to who does what, for what purpose. These magnify and add to a trust deficit between state and its intended beneficiaries, leaving status quo planned adaptation interventions – present and future – possibly less functional and efficacious.

Another example is related to the activities of the AHADS project. Under a housing project tied to it, tribal hamlets received concrete houses, which replaced traditional huts of local material. Respondents mentioned that the assistance helped them to better withstand storms – which had become more vicious and frequent. On the other hand, this coping mechanism deflects from other causes of exposure and targets locations in fragile environments – with extreme climatic events set to amplify. One could argue here that coping has disincentivised other adaptation pathways (planned or autonomous) that could be more durable.

6. Migration

Migration is documented to be a 'rational' and autonomous response strategy to spread livelihood risks and has come under renewed interest in the climate change adaptation literature (Piguet et al., 2011). Migration is an important livelihood strategy for vulnerable population sections to supplement meagre incomes and escape chronic conditions of deprivation (Sundari, 2005).

At the beginning of the 20th century, Attapaddy was mostly inhabited by tribal communities. Subsequently, it has experienced successive waves of in-and-out migration, driven by push and pull factors. Poverty and land scarcity in places of origin, ready land availability in the hilly region of the Western Ghats and conducive government policy contributed to in-migration (Velluva, 1999). The 1960s in particular witnessed a large number of settlers arriving, with a near doubling of the non-tribal population over a decade. Concomitantly, Attappady witnessed the most intense phases of land appropriation, deforestation and environmental resource base degradation. Muraleedharan et al. (1991:41) describe the landscape they witnessed in the early 1990s as 'a typical example of unplanned human settlement in a forested area which has turned the "green hell" to a "red desert".' The social and environmental pressures generated over the previous decades had apparently met a critical level in the 1980s, which made it unprofitable or too difficult for the recently arrived settlers to stay on in Attappady. Population numbers (see Table 1) show a massive outmigration of the non-tribal communities over that time. Nearly 8000 people (or 25 per cent) emigrated between 1981 and 1991. The tribal population, on the other hand, continued to stay and grow. It was only in the 1990s that the tribal population stagnated in number and reduced slightly. According to a researcher[16] working in the area in the 1980s and 1990s, one of the factors that contributed to this demographic trend was a high mortality rate (ill health and malnutrition), but not significant outmigration. The mortality rate was attributed to ill health and lack of access to food (in other words, malnutrition) expressed through a time-lag.

What explains the difference between the socially differentiated migration patterns? The settler community retains kinship ties in their former place of residence that provides a social network to return to, or to draw support from in case of shock or crisis. Kinship ties are usually maintained through marriage, extended family relations and religious group affiliation. Spouses come from the respective community, which is regionally distributed. For example, Christian settlers come from the central Travancore region (south-central Kerala), Muslim settlers from Mallapuram (North Kerala) and Tamil settlers from around Coimbatore and Theni. The women subsequently settle with their spouses in Attappady but maintain ties with their families 'back home'. The majority of non-tribal respondents are literate and possess the necessary human capital (education, skills) to navigate themselves in new surroundings and seek productive employment. This does not mean that they are necessarily 'well-off' but conditions and opportunities for social mobility exist, all of which incentivise opportunities for autonomous adaptation. Permanent relocation, as happened in the 1980s, or temporary relocation in the event of a stress situation, are common. Household members (children, spouse) shift to families in their native places to relieve pressure on household economies during prolonged drought periods, for instance. Labour migration to nearby industrial and commercial centres of Coimbatore, Mannarkad or Palakkad offers a feasible and accessible avenue for income diversification. Coimbatore is approximately 60 km from Attappady and is well connected by road.

[14] Interview: repeated in variations by a number of tribal respondents.
[15] Interview: 7 February 2013, Sholayur.
[16] Interview: 13 December 2012, Trivandrum, Kerala.

Table 1
Demographic and migration trends in Attapaddy from 1951 to 2011.
Source: GOI, 2014

Year	Tribal population	Percentage of tribal population	Non-tribal population	percentage of non-tribal population	Total population
1951	10,200	90.92	1100	9.68	11,300
1961	12,972	60.45	8489	39.55	21,461
1971	16,536	42.21	22,647	57.79	39,183
1981	20,659	33.00	41,587	67.00	62,246
1991	28,711	46.28	33,322	53.72	62,033
2001	27,121	41.00	39,050	59.00	66,171
2011	30,460	44.00	39,263	56.00	69,723

Respondents stated that they usually work in the service sector, in industrial units or the construction sector. Place attachment does not appear to be an important motivation for the non-tribal communities to remain in Attappady. This is more evident with the second and third generation of settlers. Even though they were raised in the area, they usually chose to migrate when possible – normally for higher studies or non-agricultural employment. A parent[17] substantiated: 'The agricultural situation is not easy in Attappady; it is better for our children to study and settle in one of the big towns'. Female respondents who married into families in Attappady elaborated that, given a choice, they would prefer to be elsewhere. As a respondent in Sholayur[18] mentioned, 'I came to Attapaddy because of my husband. It is okay here, but there exist few facilities and I would prefer to be in Coimbatore'. The migration option also explains the stagnation of the non-tribal population during the 1990s, with barely any population growth recorded.

On the other hand, place attachment, as with other indigenous population groups worldwide and in India (Mortreux and Barnett, 2009; Kjosavik, 2010), remains an important aspect of community and individual identity with the tribal population. Religious and cultural practices are closely interwoven with the landscape. The Malleshwaram peak juts out at a height of 1664 m at the centre of the Block and is visible from most parts of Attappady. The Irula worship it as an abode of Shiva and conduct festivals around the time of Shivaratri[19] during February–March. Its peak is worshipped by all tribal communities in differing forms, and the peak is scaled as part of ritualistic practices. Forms of animism where flora and fauna are worshipped through dance and ceremony, have traditionally been shared by all tribal communities in Attappady. The close affinity with the natural environment is interwoven into a moral economy that regulates life and death, as well social and economic practices. When a tribal labourer in Sholayur was asked why he does not want to leave, even if he faces intense hardship (in the context of unemployment), he replied, 'Attappady is my home and I will not want to leave it, it is the place our ancestors lived and I will continue to stay here'[20]. Migration is not considered a serious option or outlet, even in a crisis situation. It would imply a break with routine life rituals that provide meaning and identity. An intergenerational and gender aspect exists here. Place attachment is more important for the older generation, who are accustomed to a more 'intact' natural environment (which has been degraded for example through deforestation) and traditional socio-cultural institutions tied to it. On the other hand, younger people, especially the generation that was born in the 1990s with globalisation and economic integration holding sway, are not untouched by modernity and have a different relationship with their social and ecological environment. Still, a lack of human capital (that is, educational attainment) prevents an integration with the market economy, with illiteracy remaining widespread. Women especially, find it difficult to migrate on account of their existing household responsibilities, lack of education and social acceptability to leave behind families. A large number of children study in hostels outside Attappady; young people have at least attempted to seek employment in different parts of Kerala or Tamil Nadu. A central factor that poses a barrier to migration is widespread discrimination faced by people of tribal origin. Deeply entrenched discrimination and social stigma in Indian society towards 'primitive tribals' impedes their social mobility. Children, young adults and women who have been to the plains, experience regular discrimination, harassment and exclusion, ranging from sexual exploitation to social castigation. A young girl who studied in a college in Palakkad was adamant about not returning: 'Fellow students call me names because I am an *Adivasi* and I have to stay in a hostel with no family and few friends'[21]. This stigma contributes to an impression of the 'outside world' as not welcoming. A shared future with better opportunities away from Attappady is not considered a preferred or viable option – even in the face of environmental and economic stress.

7. On farm strategies

The agricultural sector remains the most significant economic branch in Attappady. Agricultural cultivation patterns, productivity and system adaptations are influenced by a complex set of factors and processes. They involve a dynamic interaction between market economies, knowledge systems (traditional vs modern), social organisation (culture) and biophysical base conditions.

Ethnic variations have played a central role in determining land use and cultivation patterns. The key distinguishing factor in Attappady lies in the extent of market integration between the tribal and non-tribal communities. Non-tribal households concentrate on the cultivation of cash crops that are of limited use for household consumption. These are banana, coconut, betelnut, cashew, pepper and spices, sugarcane and other cash crops. The tribal population traditionally pursue the cultivation of rain-fed crops such as pulses, oilseeds, legumes and, to a limited extent paddy, all of which are largely intended for household consumption. However, a perceptible shift has been taking place in land use patterns, away from subsistence/food crop farming, towards cash crop cultivation, with perennial plantation crops recording the strongest growth over the past two decades (Kumar et al., 2012; AHADS, 2010; GOK, 2011). As one respondent[22] noted: 'Thirty years ago we have not seen so many plantations everywhere'. The amount of agricultural land under cultivation has shown swings with an overall, sharp decline from the 1970s. In 1971, 187 square kilometres were classified as agricultural land; in 1989, this figure had changed to 52 square kilometres; in 2005, the land under cultivation was 75 square kilometres (CWRDM, 1994; Kumar et al., 2012). Qualitatively, an overall reduction in seasonal food crops and a significant growth in plantation crops can be observed. The three most important crops (by acreage under cultivation) are banana and plantains, coconut, and arecanut (GOK, 2011). Banana and plantains alone take up an area of 7911 hectares – by far the largest quantity of cultivable land. Altogether, pulses take up only 1937 hectares (GOK, 2011). The former has also seen the most significant proliferation among plantation crops. When entering the central valley from the western side of Attapaddy, with the Bhavani and Siruvani Rivers snaking through the plateau eastwards, the landscape has come to be marked by parcels of land that grow banana, plantain and coconut (see Fig. 3). The land parcels are usually located along rivers and rivulets to enable easier access to water resources. After the most fertile land is taken up for cultivation, more marginal lands, located in the higher ranges, have also come under cultivation.

What has contributed to these developments? Attappady lies in

[17] Interview: 24 February 2012, Kalamolla, Agali.
[18] Interview: 10 March 2012, Thekamake, Sholayur.
[19] Annual festival to celebrate the Hindu god 'Shiva'.
[20] Interview: 16 March 2012, Oorunchala, Sholayur.
[21] Interview: 16 January 2012, Vadakottatara, Agali.
[22] Interview: 5 April 2012, Anaikatty,Pudur.

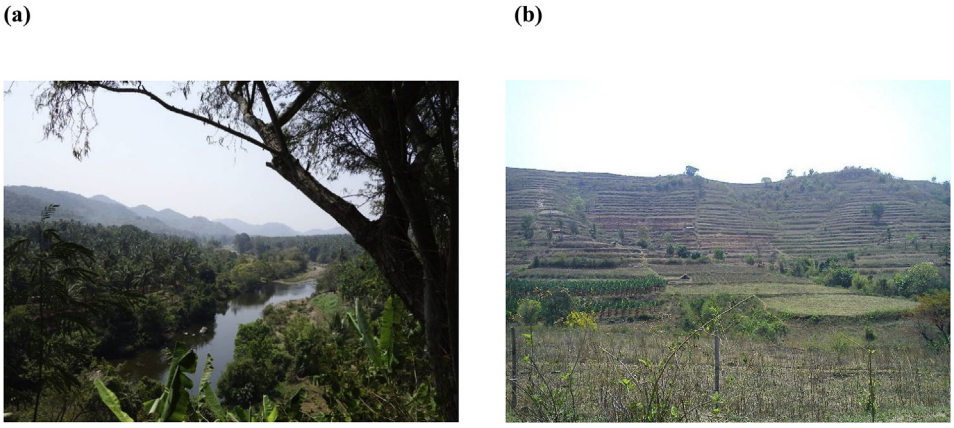

Fig. 3. Showing agricultural landscape in Attappady.
Agricultural landscape: (a) along the Bhavani River in Pudur; (b) in Sholayur panchayat, interspersed by coconut and banana plantations.

proximity to regional market centres in Kerala and Tamil Nadu. Demand from processing industries and urban consumer's ramp up market prices. Subsidy regimes by the government in Kerala encourage cultivation by lowering the price of essential inputs such as pesticides and fertilisers. Similar subsidy regimes exist for pump sets and borewells, which incentivise irrigated cultivation. The dominant perennial crops can be grown throughout the year with comparatively less labour input – irrespective of seasonal rainfall variability. Irrigated agriculture thus becomes an attractive on-farm adaptation and diversification strategy.

Rain-fed crops, traditionally cultivated by the tribal population, have by contrast witnessed a sharp decline. A third of the tribal respondents (36 per cent) in the semi-structured interviews stated that they had stopped cultivation over the past decade. The most frequently cited reason for this was lack of seasonal rain. Traditional cultivation patterns are rain-fed and depend on timely water availability. Summer rains prior to the monsoon in May have played an important role at the time of sowing in late spring when cultivation patterns were integrated with traditional, seasonal calendars. Also, a second growing season used to occur from October onwards, but rains have become less regular. Changed climatic patterns and associated aspects of traditional knowledge systems have consequently become partly redundant. Respondents confirmed that rains have become less frequent or entirely absent for consecutive years. While spatial differentiations exist, especially consecutive drought years in Pudur, respondents from all panchayats (tribal and non-tribal) agreed that rainfall quantity has reduced and that longer, more frequent droughts are observed.

Respondents have attempted to autonomously adapt, and reduce their exposure to the lack of seasonal rains by reducing their focus or giving up on seasonal crops entirely, or by shifting to intercropping patterns dominated by banana/plantain cultivation and other irrigated, perennial crops. This choice is conditioned by ecological and economic factors, but also flows into social and cultural preferences that prioritise market value over home production.

Land availability was not the main issue that obstructed agricultural cultivation among tribal respondents, as land ownership is approximately three acres per household; instead, land quality and location were the major obstructions. Lands in their effective possession were usually located along higher slopes, difficult to access and of poorer quality, needing more investment to use productively. However, funds for investments are not easy to obtain in the absence of easy access to formal credit and the high repayment burden associated with loans from informal sources. As a result marginal land holdings, debt relations, and environmental factors mutually re-enforce vulnerability and pose barriers to adaptation.

Another strategy to autonomously adapt to the lack of seasonal rains and associated income shortfalls has been to lease or sell land to absentee landowners (usually from the non-tribal community and/or residing outside of Attapaddy), a practice continued to date. The absentee landowners subsequently invest in capital-intensive irrigated agriculture. In one village in Pudur which the researcher visited, Chodipate *oore*, land originally belonging to the village and directly adjacent to it was fenced off for coconut cultivation with a borewell providing water, while local residents did not have access to a water source in the village. No recent, accurate figures on these transactions exist since they are illegal[23], but this is a common practice witnessed in all parts of Attappady. Tribal community members frequently work as casual labourers on these farmsteads, but since they require less labour input, they provide only a limited amount of work. The researcher also observed a number of worksites under the MGNREGA where participants worked on such farmsteads – effectively subsidised by the state and not allowed under the scheme's regulation.

While the livelihoods literature emphasises the importance of market integration (Ellis, 2000), the choice of what type of marketable crop to integrate poses some qualitative questions. The case of banana/plantain cultivation illustrates some dilemmas and questions regarding sustainability and negative externalities. Perennial crops are water-intense and need continuous irrigation, with most banana varieties for example, requiring water every three days over the growing period. Water scarcity is not a new phenomenon in the Block; and current trends in cultivation amplify them. Borewells and electric pumps draw water from already decimated streams and considerably reduce downstream water availability and groundwater tables, in effect contributing to water depletion. A report attributes cultivation practices to reducing the Bhavani river's flow to a 'trickle' (Shaji, 2015). Given the steep slopes of the terrain, water runoff is substantial with limited groundwater recharge possibilities (Kannan and Mathew, *unknown*). Investments in monoculture plantation require inputs in the form of pesticides and fertilisers. Given their close proximity to surface water sources, these re-enter the water cycle (streams) and pollute drinking water sources. Tribal people have a cultural preference for *pache vellam* (drinking directly from stagnant or torrid water sources) as it 'tastes better'. In the absence of a functional, treated water supply, this has negative health consequences and chronic diseases are prolific. Yet, given the lack of alternatives, drinking polluted water seems to be a necessary choice. A tribal resident[24] who accompanied the researcher to a stream stated: 'We need organic agriculture and not *vazha krishi* [banana cultivation]; they pollute our water streams and make people sick … a lot of people complain about headaches and stomach problems'.

[23] Tribal land is not transferable under the Kerala Scheduled Tribes Act (Restriction on Transfer of Lands and Restoration of Alienated Lands), 1975.
[24] Interview: 1 January 2013, Thavalam, Agali.

8. Conclusion

The article explores key adaptation trajectories and challenges in Attappady. Results show that income support from development interventions play a crucial role in the coping strategy of vulnerable people, specifically that of tribal communities. On the other hand, in terms of encouraging more long term adaptation through planning, existing interventions have been falling short and the continuing reliance on livelihood support from these interventions exemplifies a failure to successfully remove barriers to adaptation. Structural patterns of vulnerability anchored in unequal land distribution, social relations (e.g gender, discrimination, and debt relations), lack of social and human capital, and environmental change and degradation persist. These issues are also illustrated by the differences between tribal and non-tribal communities in autonomously adapting to rapid changes within Attappady. The historical underachievement of development interventions to deliver promised results have negatively affected the trust and legitimacy relationship with state institutions and potentially reduced the scope for future, planned adaptation interventions, as demonstrated by the activities of AHADS. Arguably, state-led development interventions play only one part (albeit an important one in coping) within the complex vulnerability context of Attappady.

Migration – an otherwise well-documented adaptation strategy in the face of economic and environmental stress – is a socially and culturally differentiated phenomenon, available and resorted to mostly by the non-tribal communities. Cultural attitudes, discrimination and lack of human capital severely restrict social mobility of the tribal community. In effect, migration does not constitute a practised or viable livelihood strategy. On-farm adaptation strategies mediated by climate variability is similarly differentiated. Autonomous adaptation, conditioned by market forces and social and cultural factors, have resulted in a shift towards perennial cash crop cultivation. However, it appears to be an adaptation strategy unfit for the environmentally sensitive, spatial context of the region and contributes to overexploitation of resource bases, further marginalisation of tribal communities and is ill-suited to local ecological conditions. It would seem that this is a case of maladaptation with highly problematic, long-term consequences.

The findings presented in this article highlight some of the complexities and dilemmas which confront interlinked adaptation and development choices. The tribal communities remain wedged between tradition and modernity, unable to find their place in either sphere. The traditional (social, cultural or ecological) environment has undergone rapid changes, while at the same time modernity with its demands and conditions (skills, knowledge, capital) is not fully accessible. Amplified by environmental changes, these quagmires are brought to the fore and also highlight contradictory approaches and ideas on how to address these challenges. For instance, adaptation planning through the MGNREGA attempts to facilitate a return to traditional agriculture by providing labour and resources to develop traditional land holdings, efforts that are constrained by underlying climatic and political–economic factors (Adam, *forthcoming*). On the other hand, government policies in conjunction with autonomous adaptation strategies seek to adopt 'modern' agricultural practices as expressed by subsidy regimes and resource governance patterns. In conjunction with operation of market forces, these combined adaptation responses are, however, misaligned with local development constraints and realities, and tend to further entrench marginalisation of tribal communities. Attappady's case thus presents a microcosm of development and adaptation complexities that echo the importance of addressing structural vulnerabilities and power asymmetries, if pathways towards more transformative adaptation are to succeed.

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